

The Bio/Diversity Project  
Lesson Title: Using Biomimicry to Survive in the Sonoran Desert

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Grade Level: 9<sup>th</sup>

Time: 90 minutes

Adapted from: [https://www.teachengineering.org/lessons/view/van\\_biomimicry\\_lesson1](https://www.teachengineering.org/lessons/view/van_biomimicry_lesson1)

<b>AZ State Science Standard:</b>	<p><i>HS.L2U3.18</i></p> <ul style="list-style-type: none"> <li>Obtain, evaluate, and communicate about the positive and negative ethical, social, economic, and political implications of human activity on the biodiversity of an ecosystem.</li> </ul>
<b>Content Objective:</b> Math, Reading, Science, Writing, Other:	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>Apply their background knowledge of the Sonoran Desert ecology to solve an engineering and design challenge.</li> <li>Define and explain the importance of sustainable design.</li> <li>Explain the role biomimicry has for design implementation.</li> <li>Describe the importance of designing cities and manufacturing products in ways that mimic the way natural systems minimize energy use and recycle products into new, usable forms.</li> </ul>
<b>Language Objective:</b> (Optional)	N/A
<b>Scientist of the Week:</b>	<ul style="list-style-type: none"> <li>Jane Goodall</li> <li>Primatologist</li> <li>From London, but worked in Africa</li> <li>Studied chimpanzees and how their families live (the similarities between chimpanzees and humans). In April 2002 she was named a UN Ambassador of Peace.</li> </ul>

Vocabulary	Materials
<ul style="list-style-type: none"> <li>Interdisciplinary</li> <li>Collaborative</li> <li>Biomimicry</li> <li>Environmentally Conscious</li> <li>Reverse Engineering</li> <li>Design</li> </ul>	<ul style="list-style-type: none"> <li>paper</li> <li>1-2 flowers (Peruvian lilies work best)</li> <li>toothpicks, tweezers, scissors</li> <li>magnifying lenses, aluminum, cardboard</li> <li>glue</li> <li>1 sheet of blank paper</li> <li>markers or colored pencils</li> <li>Student Planning Form (attached)</li> </ul>



- [Exploring Biomimicry Worksheet](#)

**Guiding Questions:**

- How many different professions do you think got together to create this? (show picture of ENR2)
- How can nature inspire us in our everyday lives?
- Why would it be important for different fields to come together to create things? Why is it important to use nature as inspiration?
- What are some examples that you might have seen that incorporate different fields?

**Engagement/Introductory Activity:**

- Start the lesson by watching this video to introduce the natural ecology of the Sonoran Desert: <https://www.youtube.com/watch?v=xWM0hYyHDvQ>
- After the video, ask students the following questions:
  - Just how do these organisms survive and how might humans be able to learn from these highly evolved systems?
  - Why do cacti have ribs and how do animals survive in the heat of the day?
  - Who are the members of the community and how is this complicated food web balanced?
  - Can we as humans model our behaviors and practices to live as efficiently as these desert species?
  - What would we need in order to survive in the desert like these animals?
  - Answer they hopefully get to: anything that helps us have a healthy and physically able body, sustainable food supply, etc.
  - Are we able to do so without depleting resources and generating pollution?
  - How closely could we mimic their lifestyles?

**Exploratory Activity:****Surviving in the Sonoran Desert:**

- Divide students into teams of 4.
- Tell students that they are now living in the middle of the Sonoran Desert, far away from civilization. Their task is to come up with a way to live out in the Sonoran Desert in a way that is sustainable and will:
  - a) allow them to survive for a long time
  - b) will not harm the environment that they are surviving in.
- Within each team, each student will have a specific leadership role. Allow them to choose from the following options:
  1. **Designer:** responsible for drawing out the designs that the team is planning on using to create something to help them survive
  2. **Engineer:** they are responsible for making sure that it can actually be built with the supplies that are being provided for the groups. There will be a table with some random supplies that the students will be able to pull from during the activity



3. **Sustainability Manager:** responsible for making sure that the design will not harm the environment/pollinators.
  4. **Doctor:** responsible for planning out how the members of each team are going to stay healthy and come up with a plan for emergencies that may arise (and will be provided for them on the PowerPoint)
- Students will then talk with their team and begin to brainstorm for the following:
    - a design for an object that will help the team survive in the desert
    - how they will find food and water, build shelter, and deal with waste management
    - how they plan on staying healthy when an emergency comes up
  - Provide each team a piece of blank paper and the attached worksheet so that they can begin engineering a prototype for their design for a shelter that will help them survive.
  - Class share: nominate one student in each group to share one thing their group came up with to solve an issue they would run into while constructing their home.
  - Have students rationalize their “invention” and how it could be applicable in the real world to solve an issue that they might run into in their own homes.

**Explain:**

- After students have had the chance to brainstorm their ideas, present several examples of different sustainable design techniques that may be applicable in a desert setting.
- Include design examples for: agriculture, water, and pollinator-attracting designs.
- Reintroduce the concept of biomimicry and how we can use this to our advantage in this design process
- Show Videos:
  - <https://interestingengineering.com/biomimicry-9-ways-engineers-have-been-inspired-by-nature>
  - [https://www.youtube.com/watch?v=ZODvr\\_GzNc4](https://www.youtube.com/watch?v=ZODvr_GzNc4)
  - <https://www.youtube.com/watch?v=r1CpzEGhs3c>

**Extension Activity/Questions:**

- In this activity, students will participate in a lab where they will be able to dissect a flower and use it in creating their sustainable shelter that will help them survive in the desert.
- Give each group 2 flowers and access to a table of tools, including (but not limited to): toothpicks, tweezers, scissors, magnifying lenses, aluminum, cardboard, and glue
- Task student groups with creating a prototype for their shelter using only the materials provided, which mimic materials that they could find out in nature.
- Have students complete the [Exploring Biomimicry](#) worksheet throughout their lab process

**Evaluation Activity:****Exit Ticket:**

- Do you think that you would have been able to survive sustainably? Why or why not?
- Do you think that your groups’ invention would have helped you survive? Why or why not?

**Student Planning Form:  
Surviving in the Sonoran Desert**

How are pollinators and other living desert organisms key to survival?

You need a strong body in order to survive - how are you going to ensure that you will have that?

What makes it so difficult to survive in the desert?

What makes a desert different from other ecosystems within the U.S.?

How can you use the collective different knowledge in your group to help ensure you survive for the longest amount of time possible?

What is one strength that each person in your group has?

How are you going to make sure that you are surviving sustainably (without harming the Earth)?